

What is claimed is:

1. An isolated, modified hepsin molecule, or fragment or derivative thereof, comprising a substitute activation sequence.
2. The isolated molecule of claim 1, wherein the substitute activation sequence replaces a wildtype activation sequence RIVGG of Figure 17.
3. The isolated molecule of claim 1, wherein the substitute activation sequence is DDDDKIVGG as shown in Figure 18.
4. The isolated molecule of claim 1, having the amino acid sequence as shown in Figure 18.
5. The isolated molecule of claim 1, wherein the substitute activation sequence is any one of SEQ ID NOS:1-4.
6. The isolated molecule of claim 1, wherein the substitute activation sequence is recognized and cleaved by a protease.
7. The isolated molecule of claim 1, wherein the substitute activation sequence is recognized and cleaved by a serine protease.
8. The isolated molecule of claim 1, wherein the substitute activation sequence is recognized and cleaved by a type II transmembrane protease.
9. The isolated molecule of claim 1, wherein the substitute activation sequence is DDDDK-IVGG (SEQ ID NO.: 3), which is recognized and cleaved by enterokinase.
10. The isolated molecule of claim 1, wherein the substitute activation sequence is recognized and cleaved by thrombin, clotting factor Xa, furin, trypsin, chymotrypsin, elastase, thrombin, plasmin, kallikrein, aerosin, human airway trypsin-like protease

(HAT), mast cell tryptase, MBL-associated serine proteases (MASP-1 and MASP-2), corin, MT-SP1/matryptase, TMPRSS2 or Stubble-stubloid

11. The isolated molecule of claim 1, further comprising a signal peptide sequence.
12. The isolated molecule of claim 11, wherein the signal peptide sequence is bacterial, fungal, insect, plant, or animal.
13. The isolated molecule of claim 11, wherein the signal peptide is an Igκ signal sequence.
14. The isolated molecule of claim 1, further comprising an epitope tag.
15. The isolated molecule of claim 14, wherein the epitope tag is an amino acid tag.
16. The isolated molecule of claim 14, wherein the epitope tag is histidine or cysteine.
17. The isolated molecule of claim 14, wherein the epitope tag is V5 or flag.
18. The isolated molecule of claim 1, which is from a prokaryote or eukaryote source.
19. The isolated molecule of claim 18, wherein the eukaryote is a mammal.
20. The isolated molecule of claim 19, wherein the mammal is bovine, porcine, murine, equine, canine, feline, avian, piscine, ovine, insects, simian, or human animal.
21. An activated modified hepsin molecule, comprising a substitute activation sequence cleaved by a protease.
22. A method for detecting hepsin cleavage activity in a sample, comprising contacting the functionally-active hepsin molecule of claim 21 with a substrate under conditions so that the functionally active hepsin molecule cleaves the substrate and detecting the substrate cleavage products thereby indicating hepsin cleavage activity.

23. The method of claim 22, wherein the substrate is a chromogenic or fluorogenic substrate.
- 5 24. The method of claim 22, wherein the substrate is *N*-benzoyl-Leu-Ser-Arg-pNA.HCl, *N*-benzoyl-Ile-Glu-Phe-Ser-Arg-pNA.HCl, or *N*-benzoyl-Phe-Val-Arg-pNA.HCl.
25. The isolated, modified hepsin molecule of claim 1, wherein the substitute activation sequence has been cleaved thereby producing a modified activated hepsin molecule.
- 10 26. An isolated nucleic acid molecule encoding the modified hepsin molecule of claims 1 or 25.
27. A complementary nucleic acid molecule, comprising a nucleotide sequence complementary to the nucleic acid molecule of claim 26.
- 15 28. The nucleic acid molecule of claim 25 which is DNA or RNA.
29. The nucleic acid molecule of claim 26 which is a peptide nucleic acid molecule (PNA).
- 20 30. The nucleic acid molecule of claim 26 which is a phosphorothioate derivative molecule.
- 25 31. The nucleic acid molecule of claim 26 which is labeled so as to directly or indirectly produce a detectable signal with a compound selected from the group consisting of a radiolabel, an enzyme, a chromophore and a fluorescer.
32. A vector comprising the nucleic acid molecule of claim 26.
- 30 33. The vector of claim 32, wherein the vector is a plasmid, cosmid, BAC, YAC, PAC or a phagemid.

34. A host vector system comprising the vector of claim 32 in a suitable host cell.

35. The host vector system of claim 34, wherein the suitable host cell is a prokaryotic or eukaryotic cell.

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36. The host vector system of claim 35, wherein the prokaryotic cell is a bacterial cell.

37. The host vector system of claim 35, wherein the eukaryotic cell is a yeast, plant, insect or mammalian cell.

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38. The host vector system of claim 37, wherein the insect cell is Sf21.

39. A DNA sequence as depicted in Figure 9, Figure 10, or Figure 11.

15 40. A method for detecting in a sample the presence of a nucleic acid molecule encoding a modified hepsin molecule, comprising contacting the sample with the nucleic acid molecule of claim 26 and detecting a complex formed between the nucleic acid molecule and a constituent in the sample or between the complementary nucleic acid molecule and a constituent in the sample, wherein the complex indicates the presence
20 of the nucleic acid molecule encoding a modified hepsin molecule in the sample.

41. The method of claim 40, wherein the constituent is an RNA or cDNA molecule.

42. The method of claim 40, wherein the sample is a tissue, a cell, or a biological fluid.

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43. The method of claim 42, wherein the biological fluid is urine, blood sera or phlegm.

44. The method of claim 42, wherein the sample is from prostate, liver, kidney, pancreas, stomach, thyroid, testes, or ovary.

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45. A method for inducing an immune response in a subject, comprising administering the modified hepsin molecule of claim 1 to the subject.

46. A method for producing an antibody, comprising administering the modified hepsin molecule of claim 1 to a subject.

47. The method of claim 46 wherein the subject is a hepsin knock-out mouse.

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48. An antibody, or fragment or derivative thereof, which binds a modified hepsin molecule.

49. An Fab, F(ab')₂ or Fv fragment of the antibody of claim 48.

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50. The antibody of claim 48 which is a polyclonal antibody or monoclonal antibody.

51. A recombinant protein comprising the antigen-binding region of the antibody of claim 48.

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52. An antibody which competes for binding to the same epitope as the epitope bound by the antibody of claim 48.

53. The antibody of claim 48 which is a chimeric antibody.

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54. The antibody of claim 53, wherein the chimeric antibody comprises a human region and a murine region.

55. The antibody of claim 48 which is a humanized antibody.

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56. The antibody of claim 48 which is a neutralizing antibody.

57. An idiotypic antibody of the modified hepsin molecule of claim 1.

30 58. An immunoconjugate comprising the antibody of claim 48 joined to a therapeutic agent.

59. The immunoconjugate of claim 58, wherein the therapeutic agent is a cytotoxic agent.

- 5 60. The immunoconjugate of claim 59, wherein the cytotoxic agent is selected from the group consisting of ricin, doxorubicin, daunorubicin, taxol, ethiduim bromide, mitomycin, etoposide, tenoposide, vincristine, vinblastine, colchicine, dihydroxy anthracin dione, actinomycin D, diphteria toxin, *Pseudomonas* exotoxin (PE) A, PE40, abrin, glucocorticoid and radioisotopes.
61. A hybridoma which produces the antibody of claim 48.
- 10 62. A hybridoma deposited with the American Type Culture Collection and designated ATCC PTA-4561.
63. A hybridoma deposited with the American Type Culture Collection and designated ATCC _____.
- 15 64. A monoclonal antibody produced by the hybridoma of claim 61.
65. A pharmaceutical composition, comprising the antibody of claim 48 and a suitable carrier.
- 20 66. A pharmaceutical composition, comprising the molecule of claim 1 and a suitable carrier.
- 25 67. The pharmaceutical composition of claim 65 or 66, wherein the suitable carrier is selected from a group consisting of a phosphate buffered saline solution, water, emulsions, oil/water emulsion, wetting agents, sterile solutions, excipients, starch, milk, sugar, clay, gelatin, stearic acid, salts of stearic acid, magnesium stearate, calcium stearate, talc, vegetable fats or oils, gums, and glycols.
- 30 68. The pharmaceutical composition of claim 65 or 66 which is formulated as a liposome, polymeric composition, or polymer microsphere.

69. The pharmaceutical composition of claim 65 or 66 which is formulated as a tablet, coated tablet, or capsule.

70. A method for binding a hepsin molecule, comprising contacting a sample with the antibody of claim 48 so as to bind the hepsin molecule.

71. A method for detecting a hepsin molecule, comprising contacting a sample with the antibody of claim 48 and detecting the binding of the antibody with the hepsin molecule in the sample.

72. The method of claim 71, wherein the detecting comprises determining whether a complex is formed between the hepsin molecule and the antibody, wherein the complex indicates the presence of the hepsin molecule in the sample.

73. A method for detecting the presence of hepsin molecule in a subject, comprising administering to the subject the antibody of claim 48, and detecting the binding of the hepsin molecule with the antibody with the hepsin molecule in the subject.

74. The method of claim 73, wherein the detecting comprises determining whether a complex is formed between the hepsin molecule and the antibody, wherein the complex indicates the presence of the hepsin molecule in the subject.

75. A method for diagnosing a cancer expressing hepsin in a subject, comprising quantitatively determining in a sample from the subject the amount of a hepsin molecule using the antibody of claim 48, and comparing the amount of the hepsin molecule in a sample from a normal subject, the presence of a measurably different amount of the hepsin molecule between the sample from the subject and the sample from the normal subject indicating the presence of a cancer expressing hepsin in the subject.

76. A method for measuring the prognosis of a cancer expressing hepsin molecule in a subject, comprising quantitatively determining in a sample from the subject the amount of a hepsin molecule using the antibody of claim 48, and comparing the

amount of the hepsin molecule in a sample from a normal subject, the presence of a measurably different amount of the hepsin molecule between the sample from the subject and the sample from the normal subject indicating the prognosis of the cancer expressing hepsin in the subject.

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77. A method for monitoring the course of a cancer expressing hepsin molecule in a subject, comprising quantitatively determining in a first sample from the subject the amount of a hepsin molecule using the antibody of claim 48, and comparing the amount so determined with the amount of hepsin molecule present in a second sample from the subject, wherein the first and second samples are obtained from the subject at different points in time, a difference in the amounts of hepsin molecule in the first and second sample being indicative of the course of the cancer expressing hepsin molecule in the subject.

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15 78. A method for inhibiting growth of a cell expressing hepsin molecule, comprising contacting the cell with the antibody of claim 48, so as to inhibit growth of the cell.

79. A method for killing a cell expressing hepsin, comprising contacting the cell with the antibody of claim 48 so as to kill the cell.

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80. A method for inhibiting metastasis of a cancer cell expressing hepsin, comprising contacting the cancer cell with the antibody of claim 48.

81. A method for inhibiting angiogenesis of a cancer cell expressing hepsin, comprising contacting the cell with the antibody of claim 48.

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82. The method of claim 78 or 79, wherein the cell is from a prostate, prostate cancer, metastasis of prostate cancer, liver, liver cancer, metastasis of liver cancer, kidney, kidney cancer, metastasis of kidney cancer, pancreas, pancreatic cancer, metastasis of pancreatic cancer, stomach, stomach cancer, metastasis of stomach cancer, thyroid, thyroid cancer, metastasis of thyroid cancer, testes, testicular cancer, metastasis of testicular cancer, ovary, ovarian cancer, or metastasis of ovarian cancer.

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83. A method for producing an antibody that recognizes endogenous hepsin, comprising administering a modified hepsin molecule to a subject and producing the antibody.

84. A vaccine comprising the molecule of claim 1.

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85. A kit comprising the nucleic acid molecule of claim 26.